OCR co-design, SoC methods

SoC for HPC: OS / Runtimes

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SoC Methodology and Extreme Scale Challenges

1. System power & energy
2. Efficient memory su[illegible]tem
3. [illegible]Programmability: O(B) cores
4. Execution model
5. [illegible]Resiliency
6. [illegible]$$$ Cost and affordability
7. System efficiency 20+ %
8. IO and S[illegible]e support

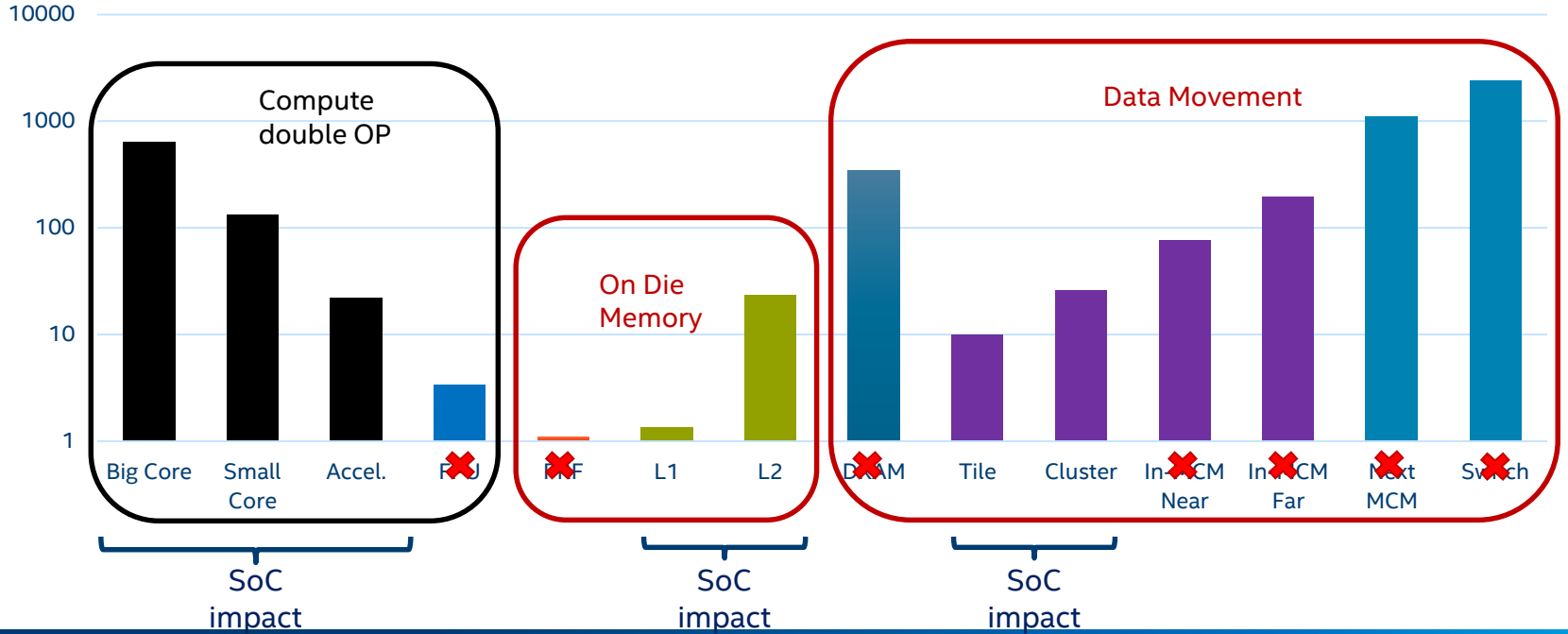
on-die

Soc Methodology brings:

- Menu of IP blocks
  - Pick your core
  - Pick your I/O
  - Pick memory pieces
- Focus on features, trade-offs
  - Quantity
  - Connectivity

Energy: double-precision op vs. moving 64 bits

BW tapering and data locality should remain the foremost consideration



Open Community Runtime (OCR)

Multi-party collaboration: Intel, Rice, UIUC, UCSD, PNNL

- Provide effective abstraction for diverse hardware (hetero-ISA ready)
- Typify future task-based execution models
- Handle large-scale parallelism efficiently and dynamically
- Provide user-perspective application-transparent resiliency
- Maintain a separation of concerns (application/scheduling/resources)
- Open source (encourage collaboration) http://xstack.exascale-tech.com
  - *OCR is X-Stack Traleika Glacier project's implementation for this revolutionary run-time prototype*
  - *FFWD-2 is extending OCR with legacy support, re-factored applications, and re-factoring guides, templates, and tools*

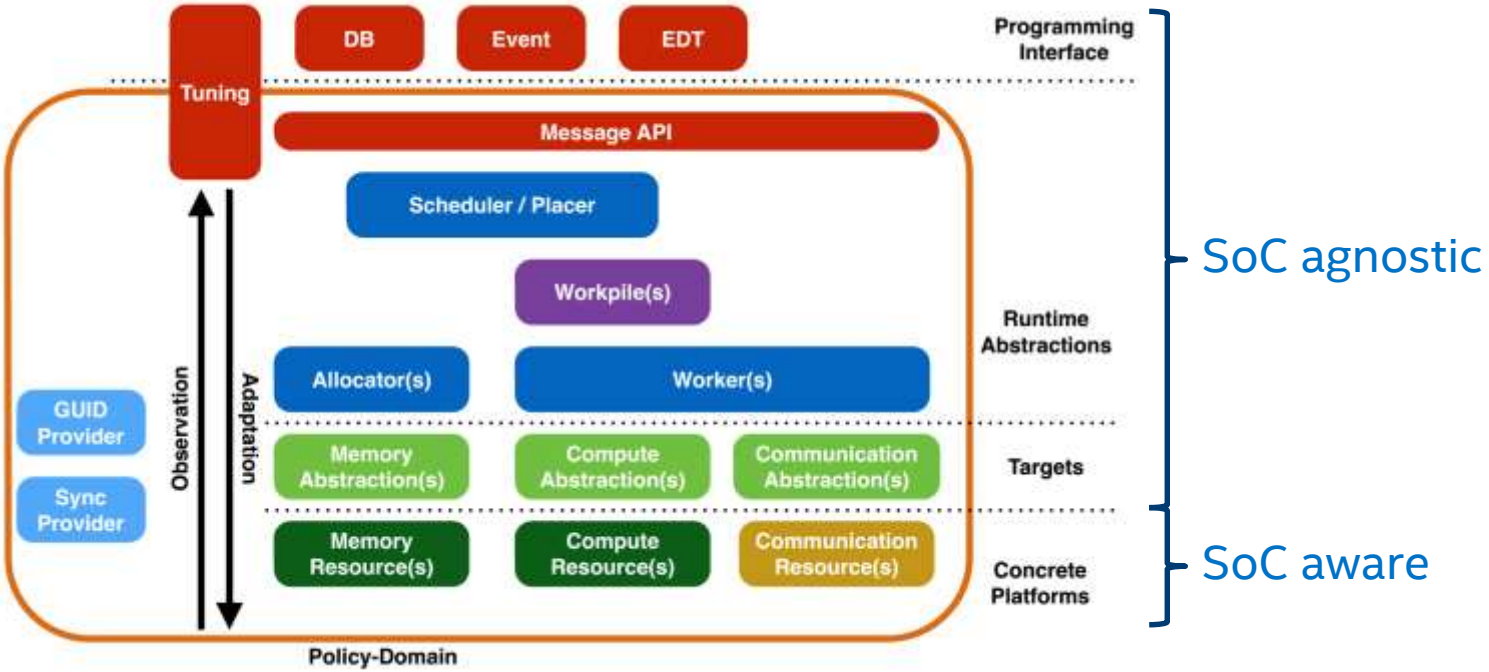
Runtime Design Principles of OCR

Modular

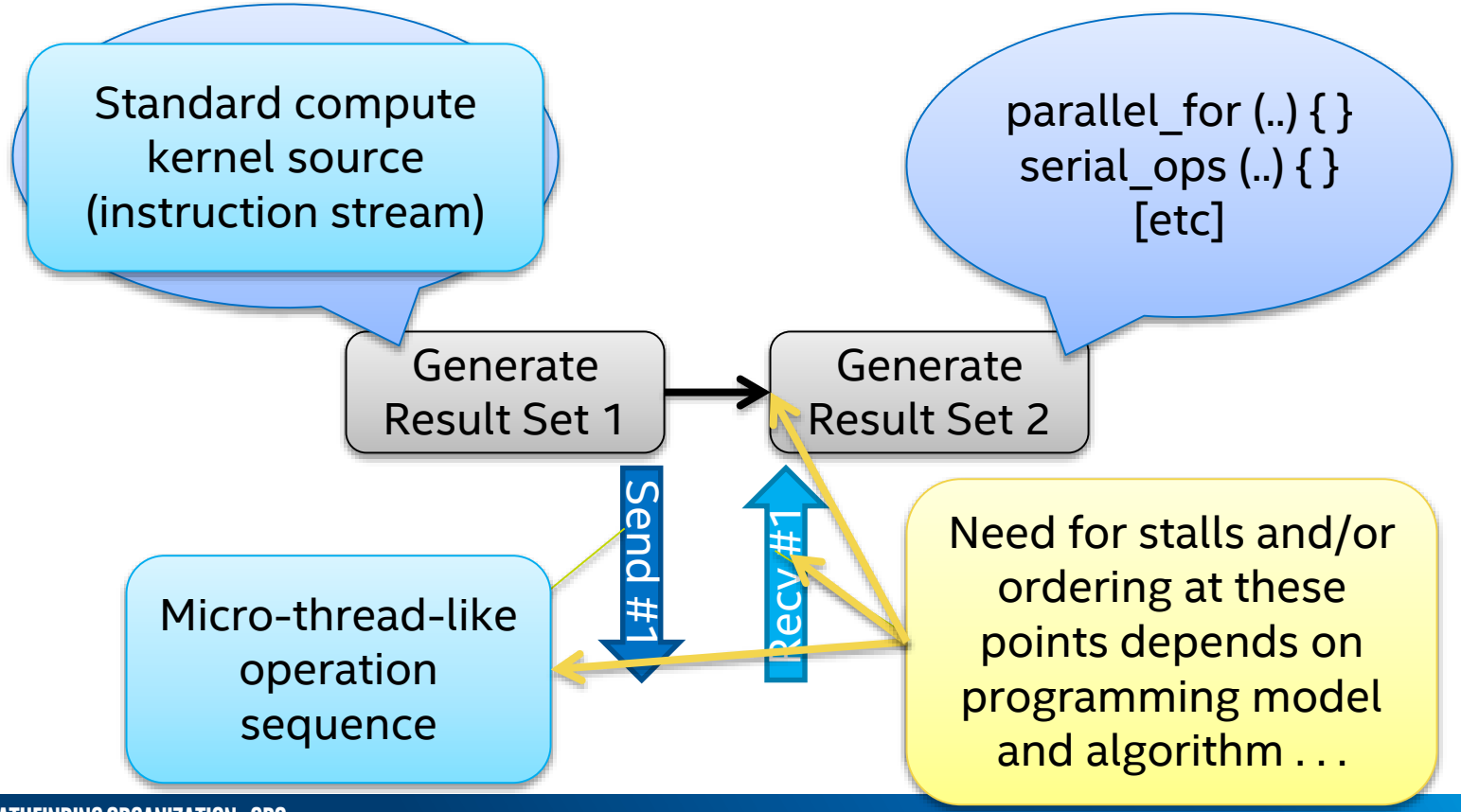
Extensible

Adaptable

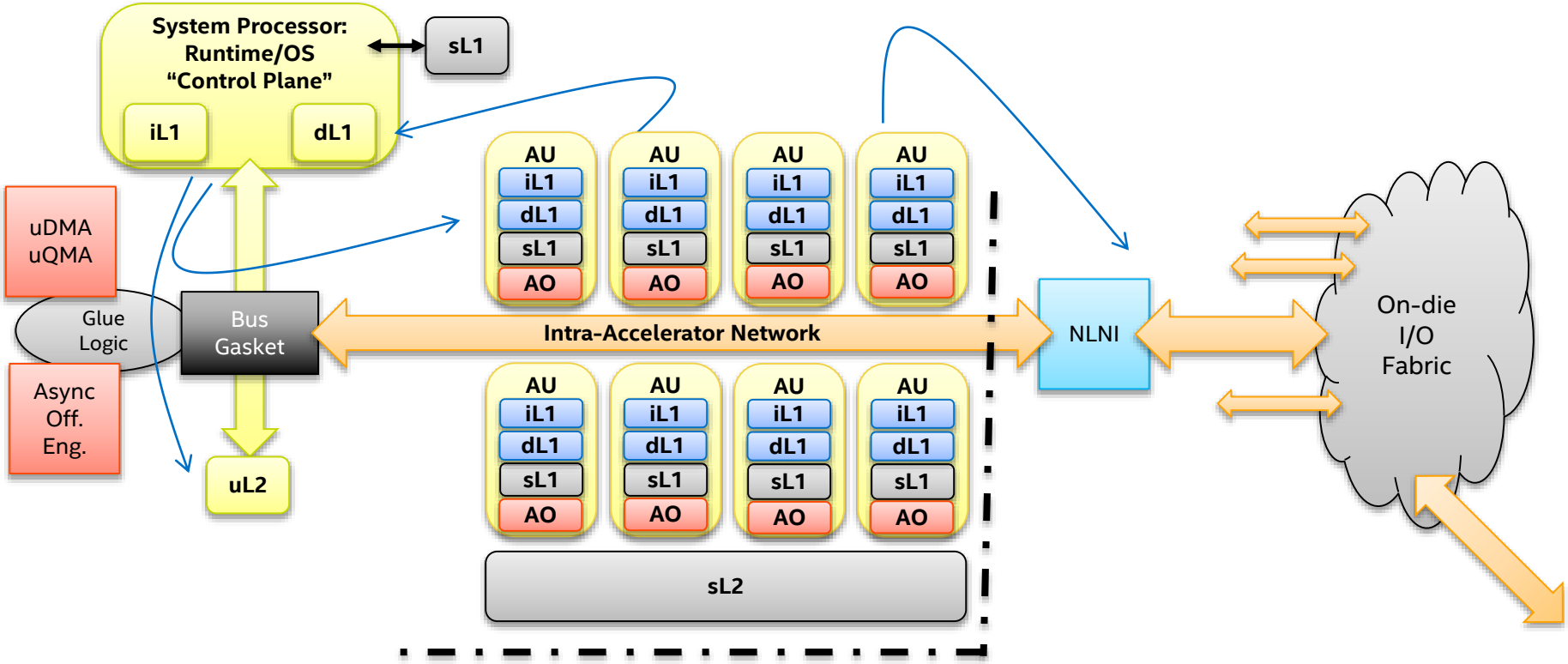
Tunable



Co-Design Opportunities via Software Analysis



OCR and SoC Methodology: Co-Design



SoC Methodology: What makes sense?

Pros:

- Tetris with IP blocks
  - Customize to your workload
  - Small “design team” to combine*
- Focus on what knobs matter
  - Combinations have impact
  - “Good enough” components
- Cost analysis is clear
  - Highly tuned and specialized for {app}
  - ROI based on *your* workloads

Cons:

- Tetris with IP blocks
  - Primitive Pete and just a hammer
  - Tweaks == not-small “design team”
- You only have a few knobs
  - They had better matter
  - May not be “good enough”
- Cost analysis is tricky
  - Volume determines $$$
  - Validation dominates TTM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